In re Application of:

WEIDONG ZHU, ***et al.***

Serial No.: 10/849,571	Group Art Unit: 2863
Filed: May 20, 2004	Examiner: Michael P. Nghiem
Docket No.: 266923-000007USPT	Confirmation No.: 6579
	Customer No.: 70001

For: **SYSTEM AND METHOD FOR DETECTING STRUCTURAL DAMAGE**

APPEAL BRIEF UNDER 35 U.S.C. 134

MAIL STOP APPEAL BRIEF – PATENTS (VIA EFS)
COMMISSIONER FOR PATENTS
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

In response to the claims set forth in the non-final Office Action mailed on March 9, 2010, a Notice of Appeal and the corresponding fee were filed on September 10, 2010, pursuant to 37 C.F.R. §§ 41.31, 41.20(b)(1). Appellant now submits the following Appeal Brief and corresponding fee pursuant to 35 U.S.C. § 134(a) and 37 C.F.R. §§ 41.37, 41.20(b)(2), for the above identified application. This Appeal Brief is being filed together with a request for and fee for a one-month extension of time to extend the response date to December 10, 2010. However, to the extent necessary, authorization is hereby provided to charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Nixon Peabody, P.C. Deposit Account No. 50-4181, Order No. 266923-000007USPT.

I. REAL PARTY IN INTEREST

The real party in interest is The University of Maryland, Baltimore County, the assignee of record, a Public University that is a member of the University System of Maryland, having its administrative offices located at 1000 Hilltop Circle, Baltimore, MD 21250.

II. RELATED APPEALS AND INTERFERENCES

There are no other prior or pending appeals, interferences, or judicial proceedings known to Appellant, Appellant's legal representative, or the Assignee, which may be properly considered to be reasonably pertinent to the Board's decision in this matter.

III. STATUS OF CLAIMS

Claims 47, 49, 56-58, 60 and 62-65 are presently pending and stand finally rejected.

Claims 1-46, 48, 50-55 and 61 stand cancelled and take no part in the instant appeal.

Claim 59 stands allowed and takes no part of the instant appeal.

The claims that are the subject of the instant appeal have been twice rejected, thus prompting the appeal from the decision of the primary examiner to the Board of Patent Appeals and Interferences.

IV. STATUS OF AMENDMENTS

Appeal is taken from the final rejection of claims set forth in the non-final Office Action dated March 9, 2010 (hereinafter "the Office Action")(**Exhibit 1**).

Amendments were introduced in the Amendment filed September 9, 2010, in which 56 was amended to address and overcome a claim objection, claim 59 was amended in independent form to place claim 59 in condition for allowance, and claims 62-65 were added. Claims 15-16, 48, 50-54 and 61 were further cancelled therein without prejudice or disclaimer to expedite prosecution.

A listing of the claims that are on appeal is provided in the attached Appendices. *See, infra* § IX, Claims on Appeal.

V. SUMMARY OF CLAIMED SUBJECT MATTER

All paragraphs and line numbers indicated below are designated with respect to the subject specification as published in U.S. Patent Application Publ. No. 2005/0072234 A1 (attached hereto as **Exhibit 2**). To that extent, much of the description set forth hereinbelow is made with respect to the various representative embodiments depicted and described in the subject specification and accompanying drawings. These descriptive comparisons and exemplifications are made purely for explanatory purposes in compliance with 37 C.F.R. § 41.37(c)(1)(v), and are therefore not intended to be limiting and should not be construed as limiting.

A. INDEPENDENT CLAIM 47

Claim 47 recites a system (100; *see e.g.*, FIG. 1A; ¶¶ [0062]-[0064]) for determining stiffness parameters of a structure, comprising a sensor (110; FIG. 1A) arranged to measure vibrations of said structure and output vibration information (*e.g.*, via sensor coupler 113; *see e.g.*, FIG. 1A; ¶ [0064]). The system (100; *see e.g.*, FIG. 1A; ¶¶ [0062]-[0064]) further comprises a stiffness parameter unit (103; *see e.g.*, FIG. 1A; ¶¶ [0064]-[0067]) for receiving said vibration information (*e.g.*, via input 114; FIG. 1A), determining natural frequency data of said

structure (*see e.g.*, ¶¶ [0062]-[0065]), and determining the stiffness parameters of said structure using said natural frequency data (*see e.g.*, ¶¶ [0064]-[0067]; see also methodology set forth in ¶¶ [0068]-[0155] and subsequent examples in ¶¶ [0156]-[0180], with subsequent simulation and experimental validation shown in ¶¶ [0181]-[0218]). The stiffness parameter unit (103; *see e.g.*, FIG. 1A; ¶¶ [0064]-[0067]) comprises an iterative processing unit (*e.g.*, 115, 117, 119; *see e.g.*, FIG. 1A; ¶¶ [0065]-[0066]) that determines said stiffness parameters using a first order eigenvalue sensitivity analysis and one of the generalized inverse method (*see, e.g.*, FIGS. 1A-1B; ¶¶ [0065]-[0066], ¶¶ [0137], [0160], [0163], [0178], [0210]), gradient method (*see, e.g.*, ¶¶ [0137]-[0144]), or quasi-Newton method (*see, e.g.*, ¶¶ [0145]-[0149]), and wherein a number of said stiffness parameters is larger than a number of system equations such that the system equations are severely underdetermined (*see, e.g.*, ¶¶ [0179]-[0182], ¶ [0188]; FIG. 12).

B. INDEPENDENT CLAIM 49

Claim 49 recites a system (100; *see e.g.*, FIG. 1A; ¶¶ [0062]-[0064]) for determining stiffness parameters of a structure, comprising a sensor (110; FIG. 1A) arranged to measure vibrations of said structure and output vibration information (*e.g.*, via sensor coupler 113; *see e.g.*, FIG. 1A; ¶ [0064]). The system (100; *see e.g.*, FIG. 1A; ¶¶ [0062]-[0064]) also includes a stiffness parameter unit (103; *see e.g.*, FIG. 1A; ¶¶ [0064]-[0067]) for receiving said vibration information (*e.g.*, via input 114; FIG. 1A) and determining said stiffness parameters with an iterative processing unit (*e.g.*, 115, 117, 119; *see e.g.*, FIG. 1A; ¶¶ [0065]-[0066]). The stiffness parameter unit (103; *see e.g.*, FIG. 1A; ¶¶ [0064]-[0067]) comprises an iterative processing unit (*e.g.*, 115, 117, 119; *see e.g.*, FIG. 1A; ¶¶ [0065]-[0066]) that determines said stiffness parameters using a first order eigenvalue sensitivity analysis (*see, e.g.*, FIGS. 1A-1B; ¶¶ [0065]-[0066], ¶¶ [0137]-[0149], [0160], [0163], [0178], [0210]), wherein a number of said stiffness parameters is larger than a number of system equations such that the system equations are

severely underdetermined (*see, e.g.*, ¶¶ [0179]-[0182], ¶ [0188]; FIG. 12).

C. Independent Claim 56

Claim 56 recites a system (100; *see e.g.*, FIG. 1A; ¶¶ [0062]-[0064]), comprising a structure (*e.g.*, 1600; FIG. 31) and a random impact device (*e.g.*, 1570, 1580; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) for introducing vibrations in said structure (*e.g.*, 1600; FIG. 31). The random impact device (*e.g.*, 1570, 1580; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) comprises a random signal generating unit (*e.g.*, 1560; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) for generating first outputs (*e.g.*, 1590; FIG. 31; ¶¶ [0228]-[0229]) and second outputs (*e.g.*, 1591; FIG. 31; ¶¶ [0228]-[0229]). The random impact device (*e.g.*, 1570, 1580; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) comprises a random impact actuator (*e.g.*, 1570; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) receives the first and second outputs (*e.g.*, 1590, 1591; FIG. 31; ¶¶ [0228]-[0229]). The random impact device (*e.g.*, 1570, 1580; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) comprises an impact applicator (*e.g.*, 1580; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) coupled to the random impact actuator (*e.g.*, 1570; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]). The random impact actuator (*e.g.*, 1570; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) drives the impact applicator (*e.g.*, 1580; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) such that force and arrival times of the impact applicator at said structure (*e.g.*, 1600; FIG. 31) are random (*see, e.g.*, ¶ [0231). A sensor (*e.g.*, 110; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) is arranged to measure vibrations of the structure and output vibration information (*e.g.*, via sensor coupler 113; *see e.g.*, FIG. 31; ¶ [0232]) and a stiffness parameter unit (103; *see e.g.*, FIG. 31; ¶ [0228], ¶ [0232]) is provided to receive the vibration information output by the sensor (*e.g.*, 110), determine natural frequency data of the structure (*e.g.*, 1600; FIG. 31; ¶ [0232]), and determine the stiffness parameters (*see, e.g.*, ¶ [0232]) of the structure using the natural frequency data.

D. Independent Claim 60

Claim 60 recites a system (100; *see e.g.*, FIG. 1A; ¶¶ [0062]-[0064]) for determining stiffness parameters of a structure, comprising a sensor (110; FIG. 1A) arranged to measure vibrations of said structure and output vibration information (*e.g.*, via sensor coupler 113; *see e.g.*, FIG. 1A; ¶ [0064]) and a stiffness parameter unit (103; *see e.g.*, FIG. 1A; ¶¶ [0064]-[0067]) for receiving said vibration information (*e.g.*, via input 114; FIG. 1A), determining mode shape information (*e.g.*, 115, 117, 119; *see e.g.*, FIG. 1A; ¶¶ [0064]-[0065]; [0195], [205], [0210]-[0211], [0216], [0220]-[0232]), and determining the stiffness parameters of said structure using said mode shape information (*see, e.g.*, FIGS. 1A-1B; ¶¶ [0064]-[0065], ¶¶ [0064]-[0065]; [0195], [205], [0210]-[0211], [0216], [0220]-[0232]). The stiffness parameter unit (103; *see e.g.*, FIG. 1A; ¶¶ [0064]-[0067]) comprises an iterative processing unit (*e.g.*, 115, 117, 119; *see e.g.*, FIG. 1A; ¶¶ [0065]-[0066]) that determines said stiffness parameters using a first order eigenvector sensitivity analysis (*see, e.g.*, FIGS. 1A-1B; ¶¶ [0065]-[0066], ¶¶ [0137]-[0149], [0160], [0163], [0178], [0210]), wherein a number of said stiffness parameters is larger than a number of system equations such that the system equations are severely underdetermined (*see, e.g.*, ¶¶ [0179]-[0182], ¶ [0188]; FIG. 12).

E. Independent Claim 62

Claim 56 recites a system (100; *see e.g.*, FIG. 1A; ¶¶ [0062]-[0064]), comprising a random impact device (*e.g.*, 1570, 1580; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) for introducing vibrations in a structure (*e.g.*, 1600; FIG. 31). The random impact device (*e.g.*, 1570, 1580; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) comprises a random signal generating unit (*e.g.*, 1560; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) for generating first outputs (*e.g.*, 1590; FIG. 31; ¶¶ [0228]-[0229]) and second outputs (*e.g.*, 1591; FIG. 31; ¶¶ [0228]-[0229]). The random impact device (*e.g.*, 1570, 1580; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) comprises a random impact actuator

(*e.g.*, 1570; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) receives the first and second outputs (*e.g.*, 1590, 1591; FIG. 31; ¶¶ [0228]-[0229]). The random impact device (*e.g.*, 1570, 1580; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) comprises an impact applicator (*e.g.*, 1580; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) coupled to the random impact actuator (*e.g.*, 1570; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]). The random impact actuator (*e.g.*, 1570; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) drives the impact applicator (*e.g.*, 1580; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) such that force and arrival times of the impact applicator at said structure (*e.g.*, 1600; FIG. 31) are random (*see, e.g.*, ¶ [0231). A sensor (*e.g.*, 110; FIG. 31; *see, e.g.*, ¶¶ [0227]-[0232]) is arranged to measure vibrations of the structure and output vibration information (*e.g.*, via sensor coupler 113; *see e.g.*, FIG. 31; ¶ [0232]) and a stiffness parameter unit (103; *see e.g.*, FIG. 31; ¶ [0228], ¶ [0232]) is provided to receive the vibration information output by the sensor (*e.g.*, 110), determine natural frequency data of the structure (*e.g.*, 1600; FIG. 31; ¶ [0232]), and determine the stiffness parameters (*see, e.g.*, ¶ [0232]) of the structure using the natural frequency data.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Whether claims 47, 49, and 60 have been shown by the Examiner to be indefinite under 35 U.S.C. § 112, second paragraph.

2. Whether claims 47, 49, and 60 have been shown by the Examiner to fail to comply with the written description requirement under 35 U.S.C. 112, first paragraph.

3. Whether claims 56-58 has been shown by the Examiner to be unpatentable under 35 U.S.C. 103(a) over Stubbs (US 5,327,358).

VII. ARGUMENTS

1. 35 USC § 112, 2ND PARAGRAPH REJECTION

Claims 47, 49, and 60 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. The Examiner supported this rejection by presenting a query, stating "why is that

when the 'number of the stiffness parameters being larger than a number of system equations', 'the system equations are severely underdetermined'?" The Examiner stated that "[t]he system equations being severely underdetermined is not understood."

Appellants traverse this rejection and respectfully submit that claims 47, 49, and 60 particularly point out and distinctly claim the subject matter which the Appellants regard as the invention, as disclosed in Appellant's disclosure. Definiteness of claim language must be analyzed in light of (1) the content of the application disclosure, (2) the teachings of the prior art, and (3) the claim interpretation that would be given by one of ordinary skill in the art at the time the invention was made. *See, e.g., In re Moore*, 439 F.2d 1232, 1235; 169 USPQ 236, 238 (CCPA 1971). The essential inquiry is whether the claims set out and circumscribe a particular subject matter with a *reasonable* degree of clarity. A claim term that is not used or defined in the specification is not indefinite if the meaning of the claim term is discernible to one skilled in the art. *Bancorp Services, L.L.C. v. Hartford Life Ins. Co.*, 359 F.3d 1367, 1372, 69 USPQ2d 1996, 1999-2000 (Fed. Cir. 2004). Further, breadth of a claim is not to be equated with indefiniteness. *In re Miller*, 441 F.2d 689, 169 USPQ 597 (CCPA 1971).

Moreover, the requirements for clarity and precision "must be balanced with the limitations of the language and the science" and "[i]f the claims, read in light of the specification, reasonably apprise those skilled in the art both of the utilization and scope of the invention, and if the language is as precise as the subject matter permits, the statute (35 U.S.C. 112, second paragraph) demands no more." *Shatterproof Glass Corp. v. Libbey Owens Ford Co.*, 758 F.2d 613, 225 USPQ 634 (Fed. Cir. 1985); *see also, e.g., Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 231 USPQ 81 (Fed. Cir. 1986). In this regard, as stated in MPEP § 2173.05(a).II, "[i]f the proposed language is not considered as precise as the subject matter

permits, the examiner should provide reasons to support the conclusion of indefiniteness and is encouraged to suggest alternatives that are free from objection."

The Examiner in the instant case has not provided **reasons** to support the conclusion of indefiniteness, but has instead merely set forth a question coupled with an admission of a lack of understanding. A statement of rejection under any ground requires a *prima facie* showing and a rejection under 35 U.S.C. § 112, second paragraph should "provide ***an analysis*** as to ***why*** the phrase(s) used in the claim is 'vague and indefinite'" (*see, e.g.*, MPEP § 2173.02)(emphasis added). Accordingly, it is submitted that, at least upon this ground, the 35 U.S.C. § 112, second paragraph rejection is improper and the Examiner's rejection should be reversed.

As to the analysis of definiteness of the claim language in light of the content of the application disclosure, the teachings of the prior art, and the claim interpretation that would be given by one of ordinary skill in the art at the time the invention was made, it is initially noted that, as is common knowledge, if there are fewer measurements available then there are unknown parameters for a system to be modeled, then the parameter estimation problem is said to be "underdetermined." Stated differently, for a linear system having m equations and n unknowns, the system is "underdetermined" if $n > m$ (and is "overdetermined" if $m > n$). Severely underdetermined system of linear equations include systems wherein $n >> m$ (i.e., far more unknowns than equations, where n represents unknowns and m represents equations). Information which is well known in the art need not be described in detail in the specification. *See, e.g., Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1379-80, 231 USPQ 81, 90 (Fed. Cir. 1986). Turning to the "teachings of the prior art," it is noted that printed patents and patent application publications utilizing the terminology "severely underdetermined" do not themselves explicitly define "severely underdetermined" and, instead, utilize such terminology

with the understanding that such terminology is understood by those of ordinary skill in the art, much as treatment of other mathematical concepts are not belabored (*see, e.g.*, U.S. Pat. No. 6,526,354, *stating* in col. 11, lines 50-53 that "more complex models require extremely complicated inversions, or may be severely underdetermined by the available data")(see **Exhibit 3**).

Appellant's specification states, *inter alia*, that "[i]n summary, the damage detection method identifies stiffness parameters in structures, which have a small, medium, and large level of damage if the maximum reduction in the stiffnesses is within 30%, between 30 and 70%, and over 70%, respectively" wherein "[a] large level of damage is studied in many examples because this poses the most challenging case, with sever [*sic*: severe] mismatch between the eigenparameters of the damaged and undamaged structures." (¶ [0179]). As noted in ¶ [0180], "[t]he damage detection method as embodied and broadly described herein can be applied to structures that can be modeled with beam elements" and ¶¶ [0181]-[0182] introduce damage detection using changes of natural frequencies "[f]or structures such as beams and lightning masts in electric substations, using only the changes in the natural frequencies can relatively accurately detect the location(s) and extent of damage, even though the system equations are *severely underdetermined* in each iteration." (emphasis added). Relating thereto and by way of example, ¶ [0188] of Appellant's specification cites, with reference to an example of an aluminum beam test specimen (see FIG. 12), the "*severely underdetermined system equations* (5 equations with 80 unknowns)." (emphasis added). In this example, the number of unknown significantly exceeds the number of equations. As noted above, the requirements for clarity and precision "must be balanced with the limitations of the language and the science" and "[i]f the claims, read in light of the specification, reasonably apprise those skilled in the art both of the

utilization and scope of the invention, and if the language is as precise as the subject matter permits, the statute (35 U.S.C. 112, second paragraph) demands no more." *Shatterproof Glass Corp. v. Libbey Owens Ford Co., supra*; *Hybritech, Inc. v. Monoclonal Antibodies, Inc., supra.* The terminology "severely underdetermined," in context of the knowledge of those skilled in the art, the application disclosure, and the prior art, is submitted to reasonably apprise those skilled in the art both of the utilization and scope of the invention and is submitted to be reasonably precise in view of the subject matter, in compliance with 35 U.S.C. § 112, second paragraph.

2. 35 USC § 112, 1ST PARAGRAPH REJECTION

Claims 47, 49, and 60 were rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement.

The Examiner stated that these claims contain subject matter "which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention." In particular, the Examiner states that "[t]he 'number of stiffness parameters is larger than a number of system equations such that the system equations are severely underdetermined' is not described in the original disclosure."

In determining whether a written description issue exists, the fundamental factual inquiry is whether the specification conveys with reasonably clarity to those skilled in the art that, as of the filing date sought, applicant was in possession of the invention as now claimed. *Vas-Cath, Inc. v. Mahurkar*, 935 F.2d 1555, 1563-64 (Fed. Cir. 1991). An applicant shows possession of the claimed invention by describing the claimed invention with all of its limitations using such descriptive means as words, structures, figures, diagrams, and formulas that fully set forth the claimed invention. *Lockwood v. American Airlines, Inc.*, 107 F.3d 1565, 1572 (Fed. Cir. 1997).

The subject matter of the claim need not be described literally (*i.e.*, using the same terms or *in haec verba*) in order for the disclosure to satisfy the description requirement (*see, e.g.*, MPEP § 2163.02). As noted above, Appellant's specification discloses, *inter alia*, damage detection using changes of natural frequencies "[f]or structures such as beams and lightning masts in electric substations, using only the changes in the natural frequencies can relatively accurately detect the location(s) and extent of damage, even though the system equations are *severely underdetermined* in each iteration" (¶¶ [0181]-[0182])(emphasis added) and discusses an example of an aluminum beam test specimen (see FIG. 12) with "*severely underdetermined system equations* (5 equations with 80 unknowns)." (¶ [0188])(emphasis added). This disclosure, when taken in view of the balance of Appellant's disclosure, does convey, with reasonably clarity to those skilled in the art that, as of the filing date sought, Appellants were in possession of the invention as now claimed. It is noted that the review as to written description is to be conducted from the standpoint of one of skill in the art at the time the application was filed (*see, e.g., Wang Labs. v. Toshiba Corp.*, 993 F.2d 858, 865 (Fed. Cir. 1993)) and should include a determination of the field of the invention and the level of skill and knowledge in the art, there being an inverse correlation between the level of skill and knowledge in the art and the specificity of disclosure necessary to satisfy the written description requirement. *See, e.g., Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1379-80 (Fed. Cir. 1986).

Still further, "the examiner has the initial burden, after a thorough reading and evaluation of the content of the application, of presenting evidence or reasons why a person skilled in the art would not recognize that the written description of the invention provides support for the claims." See MPEP § 2163. In particular, "[i]f applicant amends the claims and points out where and/or how the originally filed disclosure supports the amendment(s), and the examiner finds that

the disclosure does not reasonably convey that the inventor had possession of the subject matter of the amendment at the time of the filing of the application, the examiner has the initial burden of presenting evidence or reasoning to explain why persons skilled in the art would not recognize in the disclosure a description of the invention defined by the claims." (*see, e.g.*, MPEP § 2163 and MPEP § 2163.04). The claim amendments in question were introduced in the Supplemental Amendment filed on December 29, 2008, and did particularly point out where the originally filed disclosure supported the amendments. Accordingly, the Examiner has failed to discharge his burden and has further failed to set forth any factual findings supporting the conclusory allegation of lack of written description. *See, e.g., Purdue Pharma L.P. v. Faulding Inc.*, 230 F.3d 1320, 1323 (Fed. Cir. 2000)(the written description "inquiry is a factual one and must be assessed on a case-by-case basis").

For at least the above reasons, it is respectfully submitted that this Honorable Board would be proper in reversing the Examiner's 35 U.S.C. 112, first paragraph, written description rejection.

3. THE 35 U.S.C. § 103(A) REJECTION OF CLAIMS 56-58

Claims 56-58 were rejected under 35 U.S.C. § 103(a) over Stubbs (US 5,327,358).

Stubbs was alleged to disclose a system comprising "a structure (structure, Abstract, line 1; specimen 42)" and "a random impact device (impact hammer, column 5, line 51) for introducing vibrations in said structure (column 5, lines 50-53)".

Stubbs was further alleged to disclose "an impact applicator (impact hammer has steel tip, Google search, page 1, paragraph 2) such that the force (40) and arrival times of said impact applicator at said structure (42) are random (column 5, lines 50-53) such that the force (40) and arrival times of said impact applicator at said structure (42) are random (column 5,

lines 50-53)". Stubbs was also alleged to disclose "a sensor (claim 1, line 4) arranged to measure vibrations of said structure (claim 1, lines 4-5) and output vibration information (measured first signal, claim 1, lines 4-5)" and "a stiffness parameter unit for receiving said vibration information (column 1, lines 56-58; column 25, lines 31-34; 104, Fig. 5), determining natural frequency data of said structure (column 5, lines 8-9; column 7, lines 17-21; Table 14), and determining the stiffness parameters of said structure using said natural frequency data (using equation 1, column 5, which expresses the relationship between natural frequencies and stiffness parameter)."

Stubbs was acknowledged not to disclose the following claimed features:

- Regarding claim 56, said random impact device comprising a random signal generating unit for generating first and second outputs; a random impact actuator for receiving said first and second outputs; and an impact applicator coupled to said random impact actuator, wherein said random impact actuator drives said impact applicator.
- Regarding claim 57, said random impact actuator drives said impact applicator in accordance with said first and second outputs.
- Regarding claim 58, the first and second outputs comprise independent random variables.

The Examiner continued on, however, to assert that "[n]evertheless, Stubbs discloses that the random impact device is a PCB board (PCB 086B01, column 5, line 51)" and alleges "**[i]t would be obvious to electrically actuate the PCB impact device with electric signals since the device is an electrical device.**" (emphasis added).

It is not believed necessary to address all of the inaccuracies and inadequacies of the instant rejection as the Examiner has already acknowledged that Stubbs fails to disclose "said random impact device comprising a random signal generating unit for generating first and second outputs; a random impact actuator for receiving said first and second outputs; and an

impact applicator coupled to said random impact actuator, wherein said random impact actuator drives said impact applicator."

Starting first with the Appellant's claims and disclosure, claims 56-59 recite a **random impact device** for introducing vibrations in said structure, said random impact device comprising (1) a **random signal generating unit** for generating first and second outputs, (2) a **random impact actuator** for receiving said first and second outputs, and (3) an **impact applicator coupled to said random impact actuator**, wherein (4) **said random impact actuator drives said impact applicator such that force and arrival times of said impact applicator at said structure are random**.

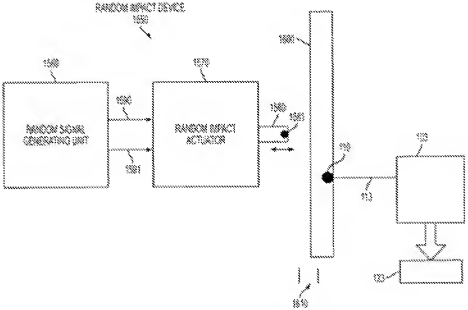

FIG. 31

As described in ¶ [0228] of Appellant's specification, FIG. 31 shows a random impact device 1550, according to one embodiment of the invention. Random impact device 1550 includes random signal generating unit 1560 and a random impact actuator 1570 with impact

applicator 1580. *Id.* The impact applicator 1580 optionally includes a sensor 1581, such as a force transducer, attached at its tip, such sensor preferably being configured to send data to the spectrum analyzer in stiffness parameter unit 103 in order to obtain mode shape information. *Id.* Random impact signal generating unit 1560 is coupled to and provides outputs 1590 and 1591 to random impact actuator 1570. *Id.*

As described in ¶ [0230] of Appellant's specification, an exemplary impact applicator 1580 is represented in FIG. 31 as an impacting structure 1600 configured for a reciprocating motion, as indicated by the dual headed arrow. Paragraph [0230] further states that impact applicator 1580 has an impact path 1610, such that when a structure 1600 lies within the impact region 1610, impact applicator 1580 impacts structure 1600 with a force of random amplitude that arrives at a random time. The impact applicator 1580 and impact region 1610 as shown in FIG. 31 is one possible embodiment, and other shapes and impact regions may be used while still falling within the scope of the present invention. *Id.*. Of course, as noted in ¶ [0231] of Appellant's specification, signal generating unit 1590 could output any signal or signals that ultimately results in random impact actuator 1570 driving impact applicator 1580 to impact structure 1600 with random arrival times τ_i and random amplitudes φ_i.

Appellant's specification further notes in ¶ [0227] that different methods have been employed in conventional vibration testing in order to excite a test specimen such as shaker testing, which can produce a high signal to noise ratio and can induce random excitation, but which can average out slight nonlinearities and extract linearized eigenparameter parameters. However, shaker testing is not practically employed in the field on relatively large structures, and can be cost prohibitive to conduct. *Id.* Appellant's specification further describes single impact hammer testing, which addresses the shortfalls of shaker testing in that it is portable

and inexpensive to conduct, but provides a low energy input and a low signal to noise ratio with no randomization. *Id.* (*see also, e.g.,* ¶¶ [0225]-[0226] (*stating* that Appellants series of random impacts has been shown to increase an energy input to the structure 10 and improve the signal to noise ratio, especially in such situations as strong wind excitation, and average out slight nonlinearities that arise, for example, from bolted joints and extract linearized eigenparameters); ¶¶ [0227]-[0323]).

Given this disclosure, attention must again be directed to the failure of Stubbs to disclosure anything resembling, let alone disclosing or suggesting, that which is recited in claims 56-58. The Examiner asserted that "Stubbs discloses that the random impact device is a PCB board (PCB 086B01, column 5, line 51)" and alleged that "[i]t would be obvious to electrically actuate the PCB impact device with electric signals since the device is an electrical device". Column 5, line 51, of Stubbs, cited by the Examiner, states that "[s]pecimen 42 receives physical excitation force 40 from an impact hammer (PCB 086B01) (not shown) having a maximum frequency range of 10 KHz." FIG. 4a merely shows, regarding such impact hammer, that an "excitation" is applied to specimen 42.

Stubbs has not been shown to disclose or suggest a random impact device comprising (1) a random signal generating unit for generating first and second outputs, (2) a random impact actuator for receiving said first and second outputs, and (3) an impact applicator coupled to said random impact actuator, wherein (4) said random impact actuator drives said impact applicator such that force and arrival times of said impact applicator at said structure are random. The entirety of the Examiner's assertion of "obviousness" is that an impact hammer is disclosed in Stubbs and that it can receive an electrical signal.

As further acknowledged by the Examiner, Stubbs also fails to disclose that the random

impact actuator drives the impact applicator in accordance with the first and second outputs from the random signal generating unit (claim 57).

As further acknowledged by the Examiner, Stubbs also fails to disclose that, further to claim 57, "the first and second outputs comprise independent random variables."

To all of these limitations, the Examiner cites to Stubbs "impact hammer" (col. 5, line 51) and apparent ability to receive an electrical signal.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *See U.S. Surgical Corp. v. Ethicon, Inc.,* 103 F.3d 1554, 1564 (Fed. Cir. 1997)(affirming a district court's instructions to a jury that "the prior art must show not only all of the elements of the claimed combination, but must contain some 'teaching, suggestion or incentive' to a person of ordinary skill to combine the known elements in the way that" the inventor combined them"); *Abbott Labs. v. Sandoz, Inc.*, 500 F. Supp. 2d 846, 851 (N.D. Ill. 2007) ("the need to demonstrate the presence of all claim limitations in the prior art (when the legal theory is based upon obviousness due to the combination of prior art teachings) has not been obviated" by *KSR*) *aff'd* 544 F.3d 1341 (Fed. Cir. 2008); *see also In re Royka*, 490 F.2d 981 (CCPA 1974). The Examiner bears the initial burden to factually support and establish *prima facie* obviousness under 35 U.S.C. § 103. *See, e.g., In re Rijckaert*, 9 F.3d 1531, 1532 (Fed. Cir. 1993); *Ex parte Koo*, Appeal No. 2008-1344 (BPAI Nov. 26, 2008), slip. op. at 8; *see also Ex Parte Wada* (*stating* "a searching comparison of the claimed invention – *including all its limitations* – with the teaching of the prior art."), Appeal 2007-3733 (BPAI, Jan. 14, 2008)(emphasis in original), slip. op. at 7. Stubbs certainly has not been shown to, and indeed does not, disclose each and every element of claims 56-58, as is recognized by the Examiner. The Examiner has not discharged his burden by the

generalized assertion that Stubbs discloses a mere impact hammer. Broad conclusory statements, standing alone, are not "evidence". *McElmurry v. Arkansas Power & Light Co.*, 995 F.2d 1576, 1578 (Fed. Cir. 1993). Thus, the Examiner's assertion of motivation fails for want of evidence for at least this reason.

"[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be 'some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.'" *KSR*, 127 S. Ct. at 1741 (*citing In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). This requirement is as much rooted in the Administrative Procedure Act ("APA"), which ensures due process and non-arbitrary decisionmaking, as it is in § 103.")(citations omitted)(*cited with approval, KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007). The Federal Circuit has stated that "rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006), *cited with approval in KSR*, 550 U.S. at 418.

The Board of Patent Appeals and Interferences has routinely reversed Examiner's for premising assertions of *prima facie* obviousness under 35 U.S.C. § 103 upon speculation or conjecture. *See, e.g., Ex parte Butterfield* (Appeal No. 2009-002995, Application 11/671,818)(Bd. Pat. App. & Inter. July 30, 2009); *Ex parte Anders* (Appeal No. 2009-000424, Application 10/759,931)(Bd. Pat. App. & Inter. July 28, 2009); *Ex parte Grunau* (Appeal No. 2009-000614, Application 10/995,959)(Bd. Pat. App. & Inter. July 9, 2009); *Ex parte Preisach* (Appeal No. 2009-003219, Application 10/752,022)(Bd. Pat. App. & Inter. June 30, 2009)(stating that "[a] rejection based on § 103 must rest upon a factual basis rather than conjecture or speculation" and that "'[w]here the legal conclusion [of obviousness] is not

supported by facts it cannot stand.'" *citing In re Warner*, 379 F.2d 1011, 1017 (CCPA 1967) and *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006))); *Ex parte Cohen-Solal* (Appeal No. 2008-005770, Application 09/896,199)(Bd. Pat. App. & Inter. June 30, 2009).

The express, implicit, and inherent disclosures of a prior art reference may be relied upon in the rejection of claims under 35 U.S.C. §§ 102 or 103. "The inherent teaching of a prior art reference, a question of fact, arises both in the context of anticipation and obviousness." *In re Napier*, 55 F.3d 610, 613 (Fed. Cir. 1995). However, a bald assertion that a certain result or characteristic *may occur* or *may be present* in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534 (Fed. Cir. 1993) (rejection reversed because alleged inherency was based on what would result due to optimization of conditions, not what was necessarily present in the prior art); *see also, In re Oelrich*, 666 F.2d 578, 581-82 (CCPA 1981). "To establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, ***may not*** be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999)(citations and internal quotations omitted)(emphasis added). To the extent an Examiner desires to rely upon the theory of inherency, the examiner <u>must</u> provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic <u>*necessarily*</u> flows from the teachings of the applied prior art. *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990). Even were the Examiner in the instant case to explicitly allege inherency, the Examiner has failed to provide a basis in fact and/or technical reasoning to reasonably support the determination that the

allegedly inherent characteristic ***necessarily*** flows from the teachings of Stubbs. It is respectfully submitted that the Examiner's implicit assertion that certain disputed element *may be possible* is factually and legally insufficient to discharge the Examiner's duty to set forth facts supporting the assertion of *prima facie* obviousness.

VIII. SUMMARY

Appellants respectfully urge this Honorable Board to reverse the Examiner on each of the aforementioned grounds of rejection presented for review on appeal.

The fee of $270.00 required by 37 C.F.R. §41.20(b)(2) is submitted herewith.

The Commissioner is hereby authorized to charge Nixon Peabody, P.C. Deposit Account No. 50-4181, Order No. 266923-000007USPT, for any fees that may be inadvertently omitted which may be necessary now or during the pendency of this application, except for payment of the issue fee. Likewise, please credit any overcharges to the same Deposit Account.

Respectfully submitted,

Date: December 10, 2010

By: /William D. PEGG, Reg. # 42,988/

William D. Pegg
Reg. No. 42,988
Attorney for Appellant
Nixon Peabody LLP
300 South Riverside Plaza
16th Floor
Chicago, Illinois 60606
(312) 425-3900

IX. APPENDIX - CLAIMS ON APPEAL

1-46. (Cancelled).

47. A system for determining stiffness parameters of a structure, comprising:

a sensor arranged to measure vibrations of said structure and output vibration information; and

a stiffness parameter unit for receiving said vibration information, determining natural frequency data of said structure, and determining the stiffness parameters of said structure using said natural frequency data;

wherein said stiffness parameter unit comprises an iterative processing unit that determines said stiffness parameters using a first order eigenvalue sensitivity analysis and one of the generalized inverse method, gradient method, or quasi-Newton method,

wherein a number of said stiffness parameters is larger than a number of system equations such that the system equations are severely underdetermined.

48. (Cancelled).

49. A system for determining stiffness parameters of a structure, comprising:

a sensor arranged to measure vibrations of said structure and output vibration information; and

a stiffness parameter unit for receiving said vibration information and determining said stiffness parameters with an iterative processing unit;

wherein said stiffness parameter unit comprises an iterative processing unit that determines said stiffness parameters using a first order eigenvalue sensitivity analysis ,

wherein a number of said stiffness parameters is larger than a number of system equations such that the system equations are severely underdetermined.

50-55. (Cancelled).

56. A system for determining stiffness parameters of a structure, comprising:

a structure;

a random impact device for introducing vibrations in said structure, said random impact device comprising:

a random signal generating unit for generating first and second outputs;

a random impact actuator for receiving said first and second outputs; and

an impact applicator coupled to said random impact actuator, wherein said random impact actuator drives said impact applicator such that force and arrival times of said impact applicator at said structure are random;

a sensor arranged to measure vibrations of said structure and output vibration information; and

a stiffness parameter unit for receiving said vibration information, determining natural frequency data of said structure, and determining the stiffness parameters of said structure using said natural frequency data.

57. The system of claim 56, wherein said random impact actuator drives said impact

applicator in accordance with said first and second outputs.

58. The system of claim 57, wherein the first and second outputs comprise independent random variables.

59. (Allowed).

60. A system for determining stiffness parameters of a structure, comprising:

a sensor arranged to measure vibrations of said structure and output vibration information; and

a stiffness parameter unit for receiving said vibration information, determining mode shape information, and determining the stiffness parameters of said structure using said mode shape information;

wherein said stiffness parameter unit comprises an iterative processing unit that determines said stiffness parameters using a first order eigenvector sensitivity analysis,

wherein a number of said stiffness parameters is larger than a number of system equations such that the system equations are severely underdetermined.

61. (Cancelled).

62. A system for determining stiffness parameters of a structure, comprising:

a random impact device configured to introduce vibrations in said structure, said random impact device comprising:

a random signal generating unit for generating first and second outputs;

a random impact actuator for receiving said first and second outputs; and

an impact applicator coupled to said random impact actuator, random impact actuator being configured to drive said impact applicator such that force amplitude and arrival times of said impact applicator at said structure are random;

a sensor arranged to measure vibrations of said structure and output vibration information; and

a stiffness parameter unit configured to receive said vibration information, determining natural frequency data of said structure, and determine the stiffness parameters of said structure using said natural frequency data.

63. The system for determining stiffness parameters of a structure in accord with claim 62, wherein said random impact actuator is configured to drive said impact applicator in accord with said first and second outputs.

64. The system for determining stiffness parameters of a structure in accord with claim 63, wherein the first and second outputs comprise independent random variables.

65. The system for determining stiffness parameters of a structure in accord with claim 64, wherein the first and second outputs determine the force amplitude and arrival times, respectively, of the impact applicator at said structure.

X. APPENDIX – EVIDENCE

1. March 9, 2010 non-final Office Action **(Exhibit 1)**
2. Copy of Appellant's U.S. Patent Application Publ. No. 2005/0072234 A1 (**Exhibit 2**).
3. U.S. Pat. No. 6,526,354 (**Exhibit 3**).

XI. APPENDIX – RELATED PROCEEDINGS

None.

XII. APPENDIX – RELATED APPLICATIONS

None.